

REMARKS

The applicants respectfully request reconsideration in view of the amendment and the following remarks. Support for amended claims 13 and 34 can be found in the published specification (U.S. 2005/0084727) in paragraph nos. [0030] and [0157]. Applicant also resubmit the Declaration of Dr. Thomas J. Schmidt Under 37 C.F.R. 1.132.

The Examiner has restricted claims 35-44 out. The Examiner stated

Newly submitted claims 35-44 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: The membrane as set forth in original claims 13, 15-16, 18-22, and 34 can be made by other viable process including graft polymerization of vinyl- containing phosphonic acid onto polymer film substrate.

The applicant respectfully traverses this restriction. The applicant believes that the Examiner would be required to search the process claims to search the product by process claims. The applicant does not believe that there is no undue burden on the Examiner to search the process claims. For the above reasons, this restriction requirement should be withdrawn.

Claims 13, 15-16, 18-22, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Formato et al. (US 6,248,469). The applicant respectfully traverses this rejection.

Rejections under 35 U.S.C. 103(a)

Claims 13, 15-16, 18-22, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Formato.

The applicants have three independent claims (claims 13, 34 and 35). It is noted that claim 35 has been restricted out. Applicants submit that independent claims 13, 34 and 35 are patentable in view of Formato for the reasons stated below. Claims 13 and 34 are product by process claims and claim 35 is a process claim (currently withdrawn). As Applicants previously noted, M.P.E.P. §2113 states:

[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The

patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted) (Claim was directed to a novolac color developer. The process of making the developer was allowed. The difference between the inventive process and the prior art was the addition of metal oxide and carboxylic acid as separate ingredients instead of adding the more expensive pre-reacted metal carboxylate. The product-by-process claim was rejected because the end product, in both the prior art and the allowed process, ends up containing metal carboxylate. The fact that the metal carboxylate is not directly added, but is instead produced in-situ does not change the end product.).

The **structure implied by the process steps** should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the **product can only be defined** by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.) (*Emphasis added.*)

In other words, if the material formed as a result of performing the steps recited in Claims 13 and 34 is inevitably different from that of Formato, then the membranes of Claims 13 and 34 are patentably distinct. As previously stated, these inevitable material differences are not required to be recited in the claims.

The Examiner at the top of page 4 of the Office Action, directed Applicants to the teachings of Formato as described in column 17, lines 22-45. Applicants note that the referenced portion of Formato describes a "fourth preferred embodiment" (column 17, lines 22-27). It is further noted that Formato teaches that the porous substrate polymer used in the fourth preferred embodiment is produced as described in a "third preferred embodiment" (Formato, column 17, lines 30-32). The third preferred embodiment, in turn, is described in Formato, column 16, line 66 through column 17, line 21. In particular, Formato states (column 17, lines 2-8):

Formato states at col. 17, lines 2-8,

A variety of methods exist for the fabrication of porous polymer films, most centered around dissolving a polymer within a water miscible solvent. A freshly

cast film is then soaked in water causing the polymer to precipitate from solution. This phase separation of the solvent and the polymer causes the formation of the porous network as the solvent is leached into the water.

In other words, a portion of an internal volume of a slab (film) of a polymer is washed away, leaving voids (pores) in the bulk of the polymer. The general method of preparing the membranes is described in detail at column 12, lines 28-47 of Formato. Specifically, the substrate polymer is formed into film with high porosity (col. 12, lines 33-36), and then immersed in water, which leaches out solvent and coagulates polymer (col. 12, lines 36-39). This process forms voids (col. 12, line 40). Ion-conducting material is then introduced into these voids either by solvent-exchange process (column 12, lines 41-42), or by infiltrating a dry membrane (column 12, line 43). This description is consistent with FIG. 1, which is a schematic illustration of the process by which Formato's membranes are prepared. As stated, in the last response, it is noted that an express description of FIG. 1 is not found in Formato. It is clear from panel A of FIG. 1 that pores (i.e. the regions in which "voids" were formed by solvent leaching) is separate and distinct from the polymer (i.e. regions in which no "voids" were formed). From panel B of FIG. 1, it is clear that whether solvent-exchange or infiltration variant of the process of Formato is used, the ion-conducting material is within the pore, and is not within the polymer regions.

In contrast, independent Claims 13 and 34 define a product obtained by (a) expanding a polymer film (the *entire* polymer film rather than only a region of the film defined by voids in the polymer material) with a liquid that contains vinyl-containing phosphonic acid monomers and (b) polymerizing the monomers in the liquid and wherein the product obtained in step (a) includes at least 50% by weight of vinyl-containing phosphonic acid (claim 13) at 70% by weight of vinyl-containing phosphonic acid (claim 34); and the intrinsic conductivity of the inventive membrane at temperatures of 160°C is at least 0.001 S/cm wherein this value is achieved without humidification and wherein the polyvinyl containing phosphonic acid formed in step b) forms an inter-penetrating network with the polymer of the polymer film from step a). Clearly, because the *entire bulk* of the polymer film recited in steps (a) of Claims 13 and 34 are imbibed with the monomer solution, the *in situ* polymerization that takes place in steps (b) of Claims 13 and 34 will result in the second polymer permeating the entirety of polymer film (in the backbone), rather than being

limited to the void regions, as in Formato's material. Therefore, Formato's membranes are structurally different from the membranes defined by independent Claims 13 and 34. Independent withdrawn claim 35 defines a process which as stated above, is not disclosed by Formato.

Additionally, Formato discloses at col. 12 line 48 through col. 13, line 3:

Preferred ion-conducting polymers for use in the present invention are easily sulfonated or synthesized from commercially-available, low-cost starting polymers, and are swellable, but highly insoluble in boiling water (100° C.) or aqueous methanol (>50%) over extended time periods. Preferred ion-conducting polymers have limited methanol permeability (limited methanol diffusivity and solubility) even at elevated temperatures and pressures, are substantially chemically stable to acids and free radicals, and thermally/hydrolytically stable to temperatures of at least about 100° C. **Preferred ion-conducting polymers have an ion-exchange capacity (IEC) of >1.0 meq/g dry membrane (preferably, 1.5 to 2.0 meq/g) and are highly ion-conducting (preferably, from about 0.01 to about 0.5 S/cm, more preferably, to greater than about 0.1 S/cm or <10Ω.cm resistivity).** Preferred ion-conducting polymers are easily cast into films and/or imbibed into the polymer substrate. Such films are durable, substantially defect-free, and dimensionally stable (less than about 20% change in dimension wet to dry) even above temperatures of at least about 100° C. Preferred ion-conducting polymers have the ability to survive operation in fuel cells (i.e., H₂ /O₂, methanol) for at least about 5000 hours (e.g., automotive applications).

Formato discloses that the **ion-conducting polymers** have ion conductivity of preferably, from about 0.01 to about 0.5 S/cm, more preferably, to greater than about 0.1 S/cm. Formato does NOT disclose the intrinsic conductivity of the inventive **MEMBRANE** at temperatures of 160°C is at least 0.001 S/cm wherein this value is achieved without humidification.

Because Formato's membranes are produced by filling the pores (voids) in the substrate polymer with the second type of material, Formato neither teaches nor suggests a membrane in which the second type of material is permeating the entirety of the first polymer material, as is the case with the membranes defined by the pending claims. Furthermore, as Applicants argued in previous responses, Applicants' membranes possess unexpected advantages not disclosed or suggested by any of the cited references, including Formato. Specifically, Applicants' membranes show conductivity at very high temperatures, above the boiling point of water, and

thus can function without moistening. (See page 5, lines 29-31, and the paragraph bridging pages 5 and 6 of the English translation of the instant Application).

Enclosed is a copy of the Declaration executed by Dr. Schmidt that was previously filed in this application. The Declaration establishes that when the polyazole polymer film was doped with 7% by weight of polyvinyl-containing phosphonic acid, it possess conductivity at 160 °C that is less than 0.00001 S/cm (10^{-5} S/cm). The applicant believes that the declaration establishes the criticality of at least 50% by weight of polyvinyl-containing phosphonic acid. For the above reasons, this rejection should be withdrawn.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Applicants believe no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 15588-00031-US from which the undersigned is authorized to draw.

Dated: July 28, 2010

Respectfully submitted,

Electronic signature: /Ashley I. Pezzner/
Ashley I. Pezzner

Registration No.: 35,646
CONNOLLY BOVE LODGE & HUTZ LLP
1007 North Orange Street
P. O. Box 2207
Wilmington, Delaware 19899-2207
(302) 658-9141
(302) 658-5614 (Fax)
Attorney for Applicant

Enclosure: Declaration of Dr. Schmidt